

Development of immunological biosensors for the detection of molecular biomarkers

V. Parro, C. Briones, J.A. Rodríguez-Manfredi, P. Fernández-Calvo, M. García-Villadangos,
L.A. Rivas, M. Moreno-Paz, J. Pérez-Mercader, J. Gómez-Elvira

Centro de Astrobiología (CSIC-INTA)

Carretera de Ajalvir, Km. 4. 28850 Torrejón de Ardoz. Madrid

SPAIN

parrogv@inta.es

Biomarkers are chemical signatures of extant or extinct life, and the development of molecular biology-based technologies that allow their detection is a relevant field of astrobiology. We have taken profit of the improved specificity of antigen-antibody recognition in order to develop immunological biosensors that allow to detect and characterize a comprehensive set of biomarkers in complex mixtures.

As a first step, we built a database including molecular biomarkers that are either the remains of, or by-products of organisms living in extreme terrestrial environments relevant for Mars exploration: acid and metal-rich, hydrothermal, and glacial. In particular, the study of chemolithoautotrophic microbial communities living in acidid iron-rich habitats allowed us to identify Mars analogue specific biomarkers. Also, we have included biomarkers from mesophilic organisms and certain molecules of interest in the fields of biotechnology, environmental control and biomedicine. The set of selected molecules belong to different families: hydrocarbons (including PAHs), lipids, porphyrins, amino acids and peptides, nucleotides and nucleic acids, cell wall components, as well as a large set of structural and functional proteins. We have raised specific polyclonal antibodies against several members of these groups. The heterogeneity of the antigens in terms of chemical nature, polarity and size, made necessary to optimize four types of immunoassays in protein microarray format: direct, sandwich, competitive and displacement. The antibodies produced have been used to build biosensors based on microarray technology, and to integrate them in the instrument SOLID, which is capable of performing autonomous detection of specific biomarkers in environmental samples.